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First report of *Erysiphe corylacearum*, agent of powdery mildew, on hazelnut (*Corylus avellana*) in Romania

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Romania has an increasing area dedicated to hazelnut (*Corylus avellana* L.), covering 890 hectares in 2019. During October 2020, powdery mildew symptoms were observed on the upper side of leaves of hazelnut 'Tonda di Giffoni' in two commercial orchards in Dudeștii Vechi, Romania (Fig. 1). The disease was present on 70% of the trees, with at least 5 leaves per tree showing powdery mildew. Micromorphological examination revealed amphigenous, hyaline, branched, septate mycelial patches of 2.3 to 3.6 µm in diameter. Conidiophores measured 24-60 × 5-6 (average: 45 × 6) µm and consisted of erect, cylindrical to flexuous foot cells, followed by 1-2 shorter cells. Ellipsoid, ovoid to doliform conidia were produced singly and they measured 19-35 × 16-24 (average: 28 × 19) µm. Chasmothecia were spherical, 75 to 107 (average: 88) µm in diameter. Nine to thirteen straight, sometimes flexuous, appendages measured 54 to 92 (average: 66) µm in length and they had five times dichotomous branched apices with curved tips (Fig. 2). Each chasmothecium contained three to five ellipsoid, ovoid to subglobose asci measuring 41-58 × 29-55 µm (average 52 × 43) µm. The asci contained four to eight ascospores measuring 13-24 × 11-15 (average 18 × 14) µm. Morphological identification was confirmed by sequencing the ITS-region of rDNA using two isolates from leaves, stored as frozen mycelium at -20°C. PCR was performed with Erysiphales-specific primer pair PMITS1/PMITS2 (Cunnington et al. 2003). The obtained sequences were deposited in GenBank (Accession n° MW423075, MW423076). Blast analysis of both sequences showed 100% identity to ITS rDNA sequences of *Erysiphe corylacearum* from Azerbaijan (Abasova et al. 2018; Accession n° LC270863), Turkey (Sezer et al. 2017; KY082910), Switzerland (Beenken

et al. 2020; MN82272), Iran (Arzanlou et al. 2018; MH047243), Italy (Mezzalama et al. 2020; MW045425) and 99% identity from Georgia (Meparishvili et al. 2019; MK157199). The sequences showed a low similarity (83%) to *Phyllactinia guttata* (Accession n° AB080558) (Fig. 3). Pathogenicity was verified on one-year-old plants of *C. avellana* 'Tonda di Giffoni', which were artificially inoculated with a conidial suspension from infected leaves (n = 25). Inoculated plants were incubated at 20 to 28°C and 70 to 80% relative humidity. White mycelium appeared on the upper surface of the leaves at 8 to 10 days after inoculation. No symptoms were found on control plants sprayed with sterile water. The fungus present on inoculated leaves was morphologically identical to the original isolates from field diseased plants. *E. corylacearum* is native to East Asia and was previously reported in Japan on wild species of *Corylus* (Takamatsu et al. 2015; Accession n° LC009928). The pathogen most likely spread into Europe from east to west of Europe (Heluta et al. 2019), through the Caucasus, starting from Turkey, Azerbaijan, Georgia, and Iran. *P. guttata* was considered the only causal agent of powdery mildew on hazelnut in most countries, including Romania (Brown 1995). Differently from *P. guttata,* which generally develops a mycelium on the underside of leaves, *E. corylacearum* grows with a white mycelium on the upper side of the leaves. Recently, *E. corylacearum* on *C. avellana* was reported also in Ukraine (Heluta et al. 2019), from which it could have moved to Romania. Crop protection strategy on hazelnut should be revised according to the new pathogen occurrence.

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Supplementary material

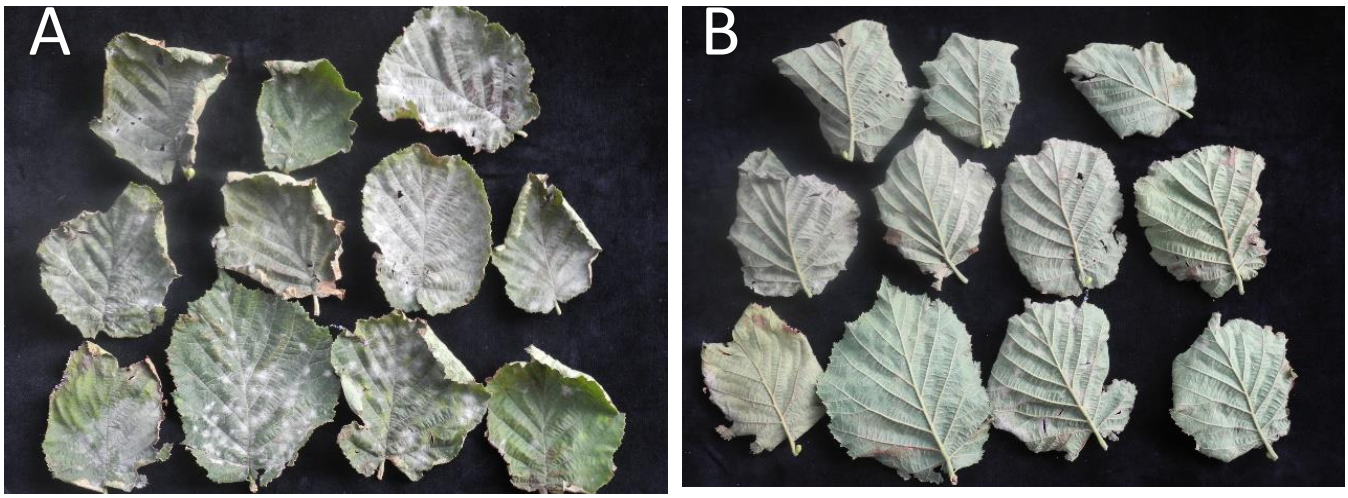

Figure 1: Symptoms of *Erysiphe corylacearum* on top (A) and bottom (B) side of leaves of *Corylus avellana.*

Figure 2: Chasmothecia with flexuous appendages.

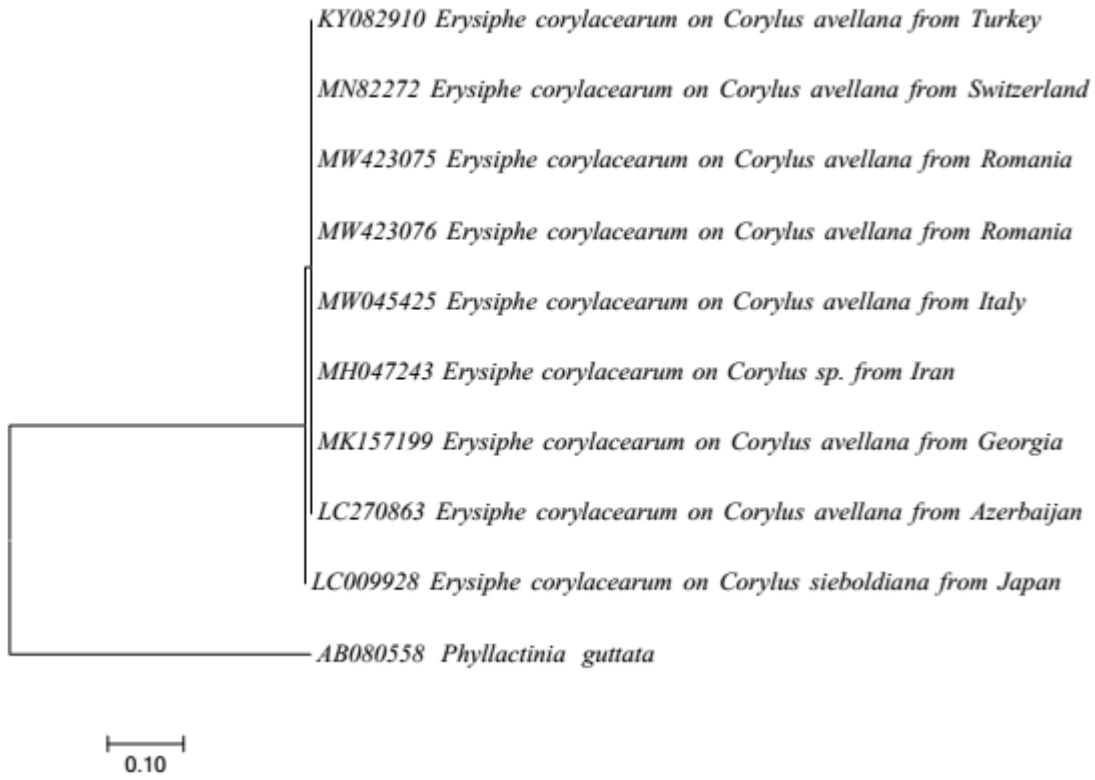

Figure 3: Phylogenetic tree based on maximum-likelihood analysis with MEGA 7 v.7.0.26 recovered from ITS sequences. Sample names include GenBank accession numbers, host plant and origin.